as body-in-white, or BIW). FIG. **36** shows that the battery pack fasteners (e.g., bolts) are fastened (e.g., torqued to specifications). For example, this can be done by one or more human operators, or by automated equipment.

[0057] FIG. **37** shows that the system is ready to lower the battery lift. FIG. **38** shows that the battery lift (outboard lifts **16**) has been lowered. FIG. **39** shows that the system is ready to close the horizontal doors (also known as battery lift doors) **20**. FIG. **40** shows that the battery lift doors **20** have been closed.

[0058] FIG. **41** shows that the system is ready to lower the vehicle lift. FIG. **42** shows that the vehicle lift has been lowered. FIG. **43** shows that after having been lowered, the vehicle can turn on its power and the status of various systems in the vehicle can be confirmed (e.g., a 12V system and a high-voltage system). The vehicle can exit the changing station in reverse, opposite to the direction of entry. FIG. **44** shows the state of the system after a swap has been completed and before the next vehicle enters, which can be serviced using the same or a similar procedure.

[0059] FIGS. **45-47** show examples relating to a battery swapping station. FIG. **45** shows that the station can have an entrance door, a vehicle lift mechanism inside the building, and an exit door. Battery packs (used as well as fresh) can be stored on a rack. A scissor lift can bring battery backs between the vehicle and a pack transfer lift, which services the roller racks. FIG. **46** shows that a forklift can be used to raise and lower the battery pack. FIG. **47** shows that a moving device for battery packs can be positioned on rails in order to move between battery storage and the serviced vehicle. The device can have a turntable on top to provide rotation of the battery pack, as needed.

[0060] Lowering the battery pack can disconnect one or more couplings. One or more other disconnects can be used in some implementations. For example, separate quick disconnects can be used for respective high-voltage connection, low-voltage connection and a coolant connection. When the battery pack is successfully mounted onto the vehicle, any quick disconnects on the vehicle are then properly connected with corresponding disconnects on the new battery pack. This can ensure proper connection of high voltage, low voltage and liquid coolant to the vehicle. For example, the vehicle's internal system can check whether there is any water intrusion into the battery pack, or whether there are any short circuits. If no errors are detected, the system can close a connect that supplies the high voltage to the vehicle.

[0061] In some implementations, there is no direct communication by the battery-swapping system with the vehicle's internal computer systems. For example, when the vehicle is placed in Park mode and the battery pack is removed, the vehicle may present (e.g., display) a message to the user to obtain a service inspection. When the battery is restored (e.g., by swapping in a new battery), and the power is cycled on, the car can recognize that valid high-voltage power is available and can enter a normal operating mode. However, in other implementations, the battery-swapping system can communicate with the vehicle system (s) to remove such error signals. For example, the vehicle's detection whether proper power is available can be temporarily disabled.

[0062] In some implementations, two or more types of battery packs can be serviced by the battery-swapping system. For example, such battery pack types can have a common external form factor and equivalent quick disconnects, but may have different energy capacity.

[0063] A battery-swapping system can be implemented on top of a trailer for increased mobility. Generally, the battery-swapping operations should be performed in an enclosed or at least covered location. For example, a trailer can be custom built with sides that pop out for increased space, and ramps on either side so the vehicle can be driven in and out of the battery-swapping facility.

[0064] Depleted batteries can be charged at the location of the swapping system (e.g., using grid power or other electric resource) or fully charged battery packs can be delivered to the location.

[0065] A number of implementations have been described as examples. Nevertheless, other implementations exist and are covered by the following claims.

What is claimed is:

1. A system for exchanging an electrical energy storage system (EESS) of an electric vehicle, the system comprising:

an EESS exchange station configured to position an electric vehicle in x and y directions;

a vehicle lift configured to raise the electric vehicle to a predetermined height;

an EESS lift configured to raise toward the raised electric vehicle until the EESS lift is correctly positioned relative to a first EESS, to engage the first EESS, and to lower the first EESS; and

an EESS conveyor located underneath the EESS lift, configured to receive the first EESS after the first EESS is lowered by the EESS lift, and configured to present a second EESS to the EESS lift, wherein the EESS lift is further configured to raise the second EESS to the electric vehicle.

2. The system of claim **1**, wherein the vehicle lift and the EESS lift comprise inboard and outboard lifts.

3. The system of claim **2**, wherein the vehicle lift is the inboard lift and the EESS lift is the outboard lift.

4. The system of claim **1**, further comprising one or more rollers configured to guide the electric vehicle.

5. The system of claim **4**, further comprising a horizontal door having at least one tube positioned thereon for guiding the electric vehicle.

6. The system of claim **1**, further comprising at least one vehicle chock for positioning the electric vehicle in at least one of the x and y directions.

7. The system of claim **1**, wherein the vehicle lift comprises lifting arms configured to engage jack pads of the electric vehicle.

8. The system of claim **7**, wherein the vehicle lift is configured to engage the electric vehicle at four points.

9. The system of claim **7**, wherein the lifting arms comprise cone locators for positioning.

10. The system of claim **1**, further comprising one or more floor doors located below the vehicle lift.

11. The system of claim **10**, wherein the one or more floor doors comprises one or more pivoting doors.

12. The system of claim **1**, wherein the EESS lift comprises ball transfer pads for engaging the EESS.

13. A system for exchanging an electrical energy storage system (EESS) of an electric vehicle, the system comprising:

an EESS exchange station configured for positioning an electric vehicle in x and y directions;